



Appendix A

Additional Monitoring Results for 1999

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This appendix contains additional information on 1999 monitoring results, supplementing the data

summarized in the main body of the report. More detailed information is available in PNNL-13230, APP. 1.



Table A.1. Radionuclide Concentrations in Columbia River Water at Priest Rapids Dam, 1999 Compared to Previous 5 Years

Radionuclide ^(a)	No. of Samples	1999		No. of Samples	1994-1998		Ambient Surface Water Quality Standard, pCi/L
		Maximum	Average		Maximum	Average	
Composite System							
Tritium	12	58 ± 7.7	37 ± 5.0	58 ^(c)	62 ± 12	36 ± 6.2	20,000 ^(d)
Alpha (gross)	12	5.6 ± 3.1	0.90 ± 0.86	60	1.6 ± 0.83	0.42 ± 0.094	15 ^(e,f)
Beta (gross)	12	7.7 ± 2.2	0.92 ± 1.9	60	3.5 ± 2.4	1.1 ± 0.26	50 ^(e,f)
Strontrium-90	12	0.097 ± 0.034	0.067 ± 0.0098	60	0.14 ± 0.0049	0.085 ± 0.0052	8 ^(e,f)
Technetium-99	12	0.45 ± 0.47	-0.024 ± 0.11	60	1.6 ± 0.69	0.030 ± 0.068	900 ^(d)
Iodine-129 ^(h)	4	0.0000066 ± 0.000011	0.0000047 ± 0.0000013	20	0.00013 ± 0.000013	0.000017 ± 0.000012	1 ^(d)
Uranium-234	12	0.42 ± 0.087	0.25 ± 0.044	60	0.44 ± 0.13	0.24 ± 0.015	-- ^(g)
Uranium-235	12	0.025 ± 0.016	0.0086 ± 0.0050	60	0.032 ± 0.039	0.0079 ± 0.0019	--
Uranium-238	12	0.38 ± 0.080	0.21 ± 0.040	60	0.35 ± 0.11	0.20 ± 0.013	--
Uranium (total)	12	0.81 ± 0.18	0.47 ± 0.084	60	0.83 ± 0.28	0.44 ± 0.028	--
Continuous System							
Beryllium-7	P	12	0.096 ± 0.021	0.039 ± 0.018	72	0.22 ± 0.092	0.043 ± 0.0085
	D	12	0.11 ± 0.061	0.044 ± 0.019			6,000 ^(d)
Potassium-40	P	12	0.28 ± 0.055	0.13 ± 0.048	72	1.0 ± 0.19	0.31 ± 0.059
	D	12	0.72 ± 0.17	0.40 ± 0.086			--
Cobalt-60	P	12	0.0013 ± 0.0016	0.000045 ± 0.00032	72	0.0065 ± 0.0057	0.00050 ± 0.00059
	D	12	0.0031 ± 0.0055	0.00068 ± 0.00086			100 ^(d)
Cesium-137	P	12	0.0031 ± 0.0016	0.0012 ± 0.00058	72	0.24 ± 5.0	0.0040 ± 0.0066
	D	12	0.0023 ± 0.0039	0.00092 ± 0.00070			200 ^(d)
Europium-155	P	12	0.0032 ± 0.0044	0.00087 ± 0.00098	72	0.012 ± 0.014	0.0011 ± 0.00090
	D	12	0.0042 ± 0.0064	-0.00032 ± 0.0017			600 ^(d)
Plutonium-239/240	P	4	0.000028 ± 0.000022	0.000023 ± 0.0000042	40	0.00028 ± 0.00010	0.000031 ± 0.000019
	D	4	0.000044 ± 0.000094	0.000021 ± 0.000020			--

(a) Radionuclides measured using the continuous system show the particulate (P) and dissolved (D) fractions separately for 1999 values, 1994-1998 values are for combined particulate and dissolved fractions. Other radionuclides are based on unfiltered samples collected by the composite system (see Section 4.2, "Surface Water and Sediment Surveillance").

(b) Maximum values are ± total propagated analytical uncertainty (2 sigma). Averages are ±2 standard error of the calculated mean.

(c) Excludes one result of 200 ± 22 pCi/L.

(d) WAC 173-201A-050 and EPA-570/9-76-003.

(e) WAC 246-290.

(f) 40 CFR 141.

(g) Dashes indicate no concentration guides available.

(h) From 1994 through 1995, iodine-129 activities were obtained from the dissolved fraction of the continuous system.

Table A.2. Radionuclide Concentrations in Columbia River Water at the Richland Pumphouse, 1999 Compared to Previous 5 Years

Radionuclide ^(a)	No. of Samples	1999		No. of Samples	1994-1998		Ambient Surface Water Quality Standard, pCi/L
		Maximum	Average		Maximum	Average	
Composite System							
Tritium	12	97 ± 11	66 ± 11	58	150 ± 11	75 ± 7.2	20,000 ^(c)
Alpha (gross)	12	1.8 ± 1.2	0.73 ± 0.28	60	2.2 ± 1.1	0.56 ± 0.11	15 ^(c,d)
Beta (gross)	12	6.6 ± 2.5	0.62 ± 1.6	60	3.4 ± 1.7	1.1 ± 0.22	50 ^(c,d)
Strontrium-90	12	0.092 ± 0.034	0.071 ± 0.014	60	0.30 ± 0.081	0.088 ± 0.0089	8 ^(c,d)
Technetium-99	12	0.23 ± 0.46	-0.022 ± 0.070	60	0.53 ± 0.52	0.029 ± 0.045	900 ^(e)
Iodine-129 ^(g)	4	0.00010 ± 0.0000044	0.000078 ± 0.000023	17	0.00016 ± 0.000013	0.00011 ± 0.000022	1 ^(e)
Uranium-234	12	0.31 ± 0.067	0.25 ± 0.019	60	0.50 ± 0.13	0.27 ± 0.020	-- ^(f)
Uranium-235	12	0.023 ± 0.016	0.11 ± 0.0034	60	0.048 ± 0.022	0.0096 ± 0.0023	--
Uranium-238	12	0.25 ± 0.057	0.21 ± 0.020	60	0.53 ± 0.14	0.22 ± 0.017	--
Uranium (total)	12	0.58 ± 0.14	0.47 ± 0.038	60	1.0 ± 0.30	0.50 ± 0.036	--
Continuous System							
Beryllium-7	P	12	0.080 ± 0.023	0.032 ± 0.011	54	28 ± 12	0.56 ± 1.0
	D	12	0.082 ± 0.049	0.038 ± 0.015			6,000 ^(e)
Potassium-40	P	12	0.20 ± 0.040	0.13 ± 0.022	53 ^(h)	0.88 ± 0.16	0.28 ± 0.063
	D	12	0.54 ± 0.090	0.42 ± 0.044			--
Cobalt-60	P	12	0.0016 ± 0.0011	0.00011 ± 0.00042	54	0.23 ± 0.69	0.0050 ± 0.0084
	D	12	0.0024 ± 0.0021	0.00034 ± 0.00081			100 ^(e)
Cesium-137	P	12	0.0037 ± 0.0015	0.0014 ± 0.00050	54	0.54 ± 0.60	-0.023 ± 0.048
	D	12	0.0026 ± 0.0018	0.0010 ± 0.00057			200 ^(e)
Europium-155	P	12	0.0016 ± 0.0032	-0.00044 ± 0.00092	54	0.040 ± 1.5	0.0010 ± 0.0017
	D	12	0.0077 ± 0.013	0.0017 ± 0.0023			600 ^(e)
Plutonium-239/240	P	4	0.000062 ± 0.000037	0.000026 ± 0.000024	34	0.00017 ± 0.000087	0.000044 ± 0.000013
	D	4	0.00016 ± 0.00091	0.000048 ± 0.000078			--

- (a) Radionuclides measured using the continuous system show the particulate (P) and dissolved (D) fractions separately for 1999 values, 1994-1998 values are for combined particulate and dissolved fractions. Other radionuclides are based on unfiltered samples collected by the composite system (see Section 4.2, "Surface Water and Sediment Surveillance").
- (b) Maximum values are ± total propagated analytical uncertainty (2 sigma). Averages are ±2 standard error of the calculated mean.
- (c) 40 CFR 141.
- (d) WAC 246-290.
- (e) WAC 173-201A-050 and EPA-570/9-76-003.
- (f) Dashes indicate no concentration guides available.
- (g) From 1994 through 1995, iodine-129 activities were obtained from the dissolved fraction of the continuous system.
- (h) Excludes one value of 110 ± 21 pCi/L on January 3, 1995.





Table A.3. Radionuclide Concentrations Measured in Columbia River Water Along Transects of the Hanford Reach, 1999

<u>Transect/Radionuclide</u>	<u>No. of Samples</u>	Concentration,^(a) pCi/L		
		<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>
Vernita Bridge (HRM 0.3)^(b)				
Tritium	12	71 ± 8.7	21 ± 5.3	38 ± 11
Strontium-90	12	0.084 ± 0.037	0.048 ± 0.027	0.072 ± 0.0064
Uranium (total)	12	0.45 ± 0.12	0.33 ± 0.096	0.39 ± 0.027
100-N Area (HRM 9.5)				
Tritium	7	87 ± 10	36 ± 6.2	51 ± 15
Strontium-90	7	0.26 ± 0.073	0.066 ± 0.032	0.11 ± 0.043
Uranium (total)	7	0.61 ± 0.23	0.33 ± 0.093	0.40 ± 0.079
100-F Area (HRM 19)				
Tritium	10	53 ± 7.2	24 ± 5.2	31 ± 5.3
Strontium-90	10	0.11 ± 0.041	0.050 ± 0.030	0.073 ± 0.011
Uranium (total)	10	0.46 ± 0.13	0.30 ± 0.091	0.37 ± 0.027
Old Hanford Townsite (HRM 28.7)				
Tritium	6	65 ± 8.1	24 ± 5.3	37 ± 13
Strontium-90	6	0.095 ± 0.039	0.059 ± 0.030	0.078 ± 0.012
Uranium (total)	6	0.44 ± 0.14	0.30 ± 0.094	0.36 ± 0.042
300 Area (HRM 43.1)				
Tritium	6	94 ± 10	57 ± 7.2	72 ± 11
Strontium-90	6	0.091 ± 0.036	0.063 ± 0.030	0.076 ± 0.0072
Uranium (total)	6	0.68 ± 0.16	0.36 ± 0.11	0.43 ± 0.10
Richland Pumphouse (HRM 46.4)				
Tritium	24	240 ± 23	27 ± 5.1	82 ± 18
Strontium-90	24	0.088 ± 0.034	0.040 ± 0.024	0.067 ± 0.0047
Uranium (total)	24	0.69 ± 0.16	0.28 ± 0.085	0.41 ± 0.042

(a) Maximum and minimum values are ± total propagated analytical uncertainty (2 sigma). Mean values are ±2 standard error of the mean.

(b) HRM = Hanford River Mile (e.g., Vernita Bridge crossing is Mile 0, the Richland Pumphouse is Mile 46.4).



Table A.4. Radionuclide Concentrations Measured in Columbia River Water at Nearshore Locations in the Hanford Reach, 1999

<u>Nearshore/Radionuclide</u>	<u>No. of Samples</u>	<u>Concentration,^(a) pCi/L</u>		
		<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>
Vernita Bridge (HRM 0.3)^(b)				
Tritium	3	71 ± 8.7	22 ± 5.3	41 ± 30
Strontium-90	3	0.080 ± 0.035	0.072 ± 0.030	0.077 ± 0.0051
Uranium (total)	3	0.45 ± 0.12	0.33 ± 0.089	0.40 ± 0.069
100-N Area (HRM 8.4 to 9.8)				
Tritium	6	110 ± 12	47 ± 6.9	77 ± 21
Strontium-90	6	1.3 ± 0.30	0.061 ± 0.031	0.40 ± 0.37
Uranium (total)	6	0.46 ± 0.12	0.32 ± 0.098	0.37 ± 0.039
100-F Area (HRM 19)				
Tritium	1	27 ± 5.4		
Strontium-90	1	0.088 ± 0.036		
Uranium (total)	1	0.36 ± 0.11		
Old Hanford Townsite (HRM 26 to 30)				
Tritium	5	51 ± 7.2	28 ± 6.0	38 ± 9.3
Strontium-90	5	0.092 ± 0.038	0.057 ± 0.033	0.065 ± 0.014
Uranium (total)	5	0.39 ± 0.3	0.29 ± 0.080	0.34 ± 0.034
300 Area (HRM 41.5 to 43.1)				
Tritium	5	1,100 ± 95	82 ± 9.2	350 ± 380
Strontium-90	5	0.078 ± 0.033	0.072 ± 0.031	0.074 ± 0.0021
Uranium (total)	5	0.53 ± 0.13	0.35 ± 0.10	0.44 ± 0.074
Richland Pumphouse (HRM 43.5 to 46.4)				
Tritium	13	110 ± 12	62 ± 7.5	87 ± 9.6
Strontium-90	13	0.082 ± 0.035	0.050 ± 0.027	0.065 ± 0.0053
Uranium (total)	13	0.52 ± 0.13	0.31 ± 0.088	0.38 ± 0.031

(a) Maximum and minimum values are ± total propagated analytical uncertainty (2 sigma). Mean values are ±2 standard error of the mean.

(b) HRM = Hanford River Mile (e.g., Vernita Bridge crossing is Mile 0, the Richland Pumphouse is Mile 46.4).

Table A.5. Selected U.S. Geological Survey Columbia River Water Quality Data,^(a) 1999

Analysis	Units	Vernita Bridge (upstream)				Richland Pumphouse (downstream)				Washington Ambient Surface Water Quality Standard^(b)
		No. of Samples	Median	Maximum	Minimum	No. of Samples	Median	Maximum	Minimum	
Temperature	°C	10	11	19	4.5	4	12	20	7.5	20 (maximum)
Dissolved oxygen	mg/L	10	12	14	10	4	11	12	9.9	8 (minimum)
Turbidity	NTU ^(c)	10	1.6	3.9	0.55	4	2	5.6	0.76	5 + background
pH	pH units	10	8.0	8.2	7.7	4	8.0	8.1	7.9	6.5 - 8.5
Suspended solids, 105°C (221°F)	mg/L	3	3.0	4	<1.0	4	2.0	5.0	1.0	-- ^(d)
Dissolved solids, 180°C (356°F)	mg/L	10	82	99	71	4	75	93	61	--
Specific conductance	µS/cm	10	125	155	110	4	126	155	105	--
Total hardness, as CaCO ₃	mg/L	10	56	71	51	4	58	70	47	--
Phosphorus, total	mg/L	9	0.01	0.017	0.007	0				--
Chromium, dissolved	µg/L	0				4	<1	<1	<0.8	--
Dissolved organic carbon	mg/L	10	1.5	2.2	1.1	4	1.6	2.2	1.2	--
Iron, dissolved	µg/L	10	<10	14	<10	0				--
Ammonia, dissolved, as N	mg/L	10	0.0045	0.012	<0.002	4	<0.02	<0.02	<0.02	--
Nitrogen, total Kjeldahl, as N	mg/L	5	0.22	0.28	0.16	3	0.26	0.37	0.17	--
Nitrite + nitrate, dissolved, as N	mg/L	10	0.001	0.003	<0.001	4	0.11	0.20	0.067	--

(a) Provisional data from U.S. Geological Survey National Stream Quality Accounting Network (NASQAN), subject to revision.

(b) From WAC 173-201A.

(c) NTU = Nephelometric turbidity units.

(d) Dashes indicate no standard available.

Table A.6. Radionuclide Concentrations in Sediments from the Columbia and Snake Rivers and from Columbia River Riverbank Springs, 1999 Compared to Previous 5 Years

Location	Radionuclide	No. of Samples	1999		No. of Samples	1994-1998	
			Concentration, pCi/g	Median^(a)		Concentration, pCi/g	Median^(a)
River Sediment							
100-F Slough	Cobalt-60	1		0.010 ± 0.015	6	0.026	0.033 ± 0.011
	Cesium-137	1		0.22 ± 0.034	6	0.37	0.49 ± 0.054
	Europium-155	1		0.040 ± 0.035	6	0.030	0.061 ± 0.033
	Plutonium-239/240	1		0.0018 ± 0.00070	6	0.0019	0.0024 ± 0.00082
	Strontium-90	1		0.0017 ± 0.0061	6	0.0044	0.013 ± 0.0052
	Uranium-235	1		0.0058 ± 0.0063	6	0.0057	0.064 ± 0.068
	Uranium-238	1		0.15 ± 0.034	6	0.56	1.4 ± 0.41
Hanford Slough	Cobalt-60	1		0.0099 ± 0.021	6	0.13	0.32 ± 0.046
	Cesium-137	1		0.16 ± 0.033	6	0.41	0.59 ± 0.068
	Europium-155	1		0.031 ± 0.050	6	0.080	0.16 ± 0.075
	Plutonium-239/240	1		0.0030 ± 0.00070	6	0.0047	0.0076 ± 0.0014
	Strontium-90	1		0.0043 ± 0.0060	6	0.0084	0.017 ± 0.0052
	Uranium-235	1		0.0087 ± 0.0070	6	0.042	0.24 ± 0.16
	Uranium-238	1		0.20 ± 0.040	6	0.93	2.4 ± 0.88
McNary Dam	Cobalt-60	6	0.029	0.075 ± 0.030	26	0.056	0.22 ± 0.040
	Cesium-137	6	0.37	0.53 ± 0.061	26	0.44	1.0 ± 0.11
	Europium-155	6	0.051	0.091 ± 0.042	26	0.055	0.13 ± 0.069
	Plutonium-239/240	6	0.0079	0.0094 ± 0.0022	26	0.0081	0.014 ± 0.0026
	Strontium-90	6	0.023	0.024 ± 0.0090	26	0.024	0.049 ± 0.011
	Uranium-235	6	0.022	0.026 ± 0.013	26	0.030	0.21 ± 0.10
	Uranium-238	6	0.53	0.60 ± 0.11	26	1.4	2.3 ± 0.71
Priest Rapids Dam	Cobalt-60	6	0.020	0.042 ± 0.041	25	0.0019	0.038 ± 0.049
	Cesium-137	6	0.40	0.60 ± 0.11	25	0.34	1.0 ± 0.14
	Europium-155	6	0.040	0.082 ± 0.088	25	0.048	0.10 ± 0.050
	Plutonium-239/240	6	0.0094	0.015 ± 0.0030	25	0.0077	0.018 ± 0.0032
	Strontium-90	6	0.014	0.019 ± 0.0080	25	0.014	0.025 ± 0.0068
	Uranium-235	6	0.014	0.037 ± 0.014	25	0.055	0.32 ± 0.17
	Uranium-238	6	0.39	0.73 ± 0.12	25	0.98	2.2 ± 0.71





Table A.6. (contd)

Location	Radionuclide	No. of Samples	1999		1994-1998		
			Median^(a)	Maximum^(b)	Median^(a)	Maximum^(b)	
Ice Harbor Dam (Snake River)	Cobalt-60	3	0.0030	0.0053 ± 0.013	3	-0.019	-0.0022 ± 0.014
	Cesium-137	3	0.27	0.28 ± 0.039	3	0.23	0.29 ± 0.044
	Europium-155	3	0.063	0.066 ± 0.035	3	0.079	0.081 ± 0.044
	Plutonium-239/240	3	0.0074	0.0095 ± 0.0020	3	0.0085	0.0087 ± 0.0019
	Strontium-90	3	0.020	0.024 ± 0.0080	3	0.018	0.019 ± 0.0095
	Uranium-235	3	0.031	0.056 ± 0.019	3	0.018	0.027 ± 0.011
	Uranium-238	3	0.59	0.64 ± 0.11	3	0.66	0.73 ± 0.090
Richland	Cobalt-60	1		0.020 ± 0.014	5	0.039	0.074 ± 0.019
	Cesium-137	1		0.24 ± 0.038	6	0.24	0.34 ± 0.042
	Europium-155	1		0.017 ± 0.042	6	0.050	0.066 ± 0.034
	Plutonium-239/240	1		0.0021 ± 0.00060	6	0.0020	0.0034 ± 0.00073
	Strontium-90	1		0.0063 ± 0.0040	6	0.0041	0.0050 ± 0.0035
	Uranium-235	1		0.0049 ± 0.0060	6	0.014	0.068 ± 0.13
	Uranium-238	1		0.19 ± 0.042	6	0.83	2.1 ± 0.54
White Bluffs Slough	Cobalt-60	1		0.044 ± 0.023	6	0.099	0.20 ± 0.031
	Cesium-137	1		0.32 ± 0.045	6	0.65	0.97 ± 0.11
	Europium-155	1		0.040 ± 0.034	6	0.051	0.10 ± 0.034
	Plutonium-239/240	1		0.0024 ± 0.00060	6	0.0045	0.0073 ± 0.0017
	Strontium-90	1		0.0023 ± 0.0030	6	0.0070	0.017 ± 0.0055
	Uranium-235	1		0.0065 ± 0.0060	6	0.0044	0.16 ± 0.12
	Uranium-238	1		0.15 ± 0.033	6	0.97	1.9 ± 0.52
Riverbank Spring Sediment							
100-B Spring (38-3)	Cobalt-60	1		0.0039 ± 0.014	4	0.025	0.051 ± 0.024
	Cesium-137	1		0.14 ± 0.026	4	0.087	0.10 ± 0.023
	Europium-155	1		0.048 ± 0.034	4	0.069	0.11 ± 0.072
	Strontium-90	1		-0.0048 ± 0.022	4	0.0034	0.0041 ± 0.0083
	Uranium-235	1		0.015 ± 0.0090	4	0.065	0.20 ± 0.10
	Uranium-238	1		0.40 ± 0.073	4	1.2	1.2 ± 0.38

Table A.6. (contd)

Location	Radionuclide	No. of Samples	1999		1994-1998	
			Concentration, pCi/g	Median^(a)	Maximum^(b)	Concentration, pCi/g
100-F Spring (207-1)	Cobalt-60	1		0.018 ± 0.014	4	0.028
	Cesium-137	1		0.20 ± 0.035	4	0.17
	Europium-155	1		0.020 ± 0.040	4	0.033
	Strontium-90	1		-0.0083 ± 0.019	4	0.0065
	Uranium-235	1		0.018 ± 0.010	5	0.083
	Uranium-238	1		0.28 ± 0.054	5	0.97
100-K Spring	Cobalt-60	(c)			2	0.011
	Cesium-137	(c)			2	0.17
	Europium-155	(c)			2	0.084
	Strontium-90	(c)			2	0.0049
	Uranium-235	(c)			2	0.17
	Uranium-238	(c)			2	1.2
300 Area Spring	Cobalt-60	2	0.016	0.020 ± 0.010	4	0.0088
	Cesium-137	2	0.13	0.21 ± 0.029	4	0.073
	Europium-155	2	0.062	0.086 ± 0.035	4	0.045
	Strontium-90	2	0.0060	0.011 ± 0.023	4	0.0075
	Uranium-235	2	0.14	0.18 ± 0.037	4	0.13
	Uranium-238	2	3.0	3.7 ± 0.57	4	2.6
Hanford Spring	Cobalt-60	2	0.049	0.067 ± 0.026	4	0.073
	Cesium-137	2	0.21	0.23 ± 0.034	4	0.25
	Europium-155	2	0.061	0.069 ± 0.035	4	0.064
	Strontium-90	2	-0.00086	0.0071 ± 0.022	4	0.0074
	Uranium-235	2	0.021	0.024 ± 0.011	4	0.024
	Uranium-238	2	0.52	0.60 ± 0.10	4	1.5

(a) Median values are not provided when only one sample analyzed.

(b) Values are ± total propagated analytical uncertainty (2 sigma).

(c) Sediment was not available at the 1999 spring location.





Table A.7. Median Metal Concentrations (mg/kg dry wt.) in Columbia and Snake River Sediments, 1999

Metal	(n=6) Priest Rapids Dam	(n=3) Hanford Reach ^(a)	(n=6) McNary Dam	(n=3) Ice Harbor Dam (Snake River)	(n=7) Riverbank Springs ^(b)
Antimony	0.86	0.75	0.86	0.78	0.59
Arsenic	9.0	6.6	8.5	8.2	5.8
Beryllium	1.6	1.8	1.8	2.0	1.2
Cadmium	6.8	1.3	1.5	0.13	0.85
Chromium	76	59	60	51	60
Copper	32	23	31	29	14
Lead	50	32	26	14	27
Mercury	0.16	0.058	0.12	0.072	0.017
Nickel	35	23	29	22	18
Selenium	0.47	0.47	0.47	0.47	0.45
Silver	0.17	0.58	0.15	0.073	0.066
Thalium	1.3	0.76	0.80	0.41	0.63
Zinc	530	280	230	94	150

(a) 100-F Slough, Hanford Slough, and White Bluffs Slough.

(b) 100-B Area, 100-F Area, Old Hanford Townsite, and 300 Area.

Table A.8. Radionuclide Concentrations Measured in Water from Riverbank Springs, 1999 Compared to Previous 5 Years

Location/Radionuclide	No. of Samples	1999		1994-1998		Washington State Ambient Surface Water Quality Standard,^(b) pCi/L
		Concentration,^(a) pCi/L Maximum	No. of Samples	Concentration,^(a) pCi/L Maximum	Median	
100-B Spring						
Alpha (gross)	2	2.0 ± 1.4	6	2.4 ± 1.2	1.5	15
Beta (gross)	2	15 ± 3.1	6	38 ± 4.6	10	50
Strontium-90	2	4.5 ± 1.0	6	0.031 ± 0.045	0.022	8
Technetium-99	0	NS	6	25 ± 3.2	10	900 ^(c)
Tritium	2	20,000 ± 870	6	24,000 ± 1,800	14,000	20,000
100-D Spring						
Alpha (gross)	2	0.50 ± 0.82	7	2.9 ± 1.9	0.98	15
Beta (gross)	2	2.9 ± 1.5	7	21 ± 3.3	9.3	50
Strontium-90	2	0.62 ± 0.15	7	9.4 ± 1.8	4.0	8
Tritium	2	270 ± 120	7	12,000 ± 1,000	4,800	20,000
100-F Spring						
Alpha (gross)	1	6.3 ± 2.8	5	41 ± 18	3.7	15
Beta (gross)	1	16 ± 3.3	5	65 ± 11	3.8	50
Strontium-90	1	0.0036 ± 0.027	5	0.099 ± 0.091	0.034	8
Tritium	1	1,400 ± 180	5	1,800 ± 240	1,110	20,000
Uranium (total)	1	4.8 ± 0.80	5	9.2 ± 1.2	4.6	-- ^(d)
100-H Spring						
Alpha (gross)	2	2.5 ± 1.6	5	10 ± 3.7	4.4	15
Beta (gross)	2	29 ± 4.8	5	72 ± 8.6	50	50
Strontium-90	2	14 ± 3.1	4	25 ± 4.5	15	8
Technetium-99	2	1.2 ± 0.47	5	140 ± 15	62	900
Tritium	2	840 ± 150	5	2,300 ± 270	1,100	20,000
Uranium (total)	2	1.4 ± 0.27	5	9.3 ± 1.0	8.0	--
100-K Spring						
Alpha (gross)	1	4.1 ± 2.1	4	3.2 ± 1.8	0.61	15
Beta (gross)	1	6.3 ± 2.1	4	5.0 ± 2.4	1.8	50
Strontium-90	1	0.023 ± 0.032	4	0.59 ± 0.13	0.035	8
Tritium	1	6,700 ± 390	4	20,000 ± 1,500	12,000	20,000





Table A.8. (contd)

<u>Location/Radionuclide</u>	1999			1994-1998			Washington State Ambient Surface Water Quality Standard,^(b) pCi/L
	<u>No. of Samples</u>	<u>Concentration,^(a) pCi/L</u>	<u>Maximum</u>	<u>No. of Samples</u>	<u>Concentration,^(a) pCi/L</u>	<u>Maximum</u>	
100-N Spring (8-13)^(c)							
Alpha (gross)	1	0.84 ± 0.97		5	8.1 ± 3.3	0.72	15
Beta (gross)	1	2.9 ± 1.7		5	8.8 ± 2.3	3.5	50
Strontium-90	1	0.026 ± 0.034		5	0.59 ± 0.13	0.079	8
Tritium	1	14,000 ± 670		5	31,000 ± 2,400	19,000	20,000
300 Area Spring							
Alpha (gross)	2	230 ± 49		6	110 ± 21	50	15
Beta (gross)	2	49 ± 7.9		6	21 ± 4.1	13	50
Iodine-129	2	0.0062 ± 0.00056		5	0.0055 ± 0.00058	0.0047	1
Technetium-99	0	NS ^(d)		6	14 ± 1.9	11	900 ^(e)
Tritium	2	11,000 ± 570		6	12,000 ± 940	9,900	20,000
Uranium (total)	2	210 ± 38		6	110 ± 13	59	-- ^(f)
Old Hanford Townsite Spring							
Alpha (gross)	3	14 ± 5.9		6	4.9 ± 2.2	2.1	15
Beta (gross)	3	49 ± 7.9		6	23 ± 4.3	13	50
Iodine-129	3	0.41 ± 0.024		5	0.22 ± 0.030	0.086	1
Technetium-99	3	120 ± 8.0		6	100 ± 12	41	900 ^(e)
Tritium	3	110,000 ± 4,100		6	170,000 ± 13,000	48,000	20,000
Uranium (total)	3	8.6 ± 1.5		6	4.0 ± 0.58	2.4	--

(a) Maximum values are ± total propagated analytical uncertainty (2 sigma).

(b) WAC 246-290, 40 CFR 141, and Appendix C, Table C.2.

(c) Refer to Table 4.2.4 for additional details on 100-N Spring samples.

(d) NS = No sample.

(e) WAC 173-201A-050 and EPA-570/9-76-003.

(f) Dashes indicate no concentration guides available.



References

- 40 CFR 141. U.S. Environmental Protection Agency. "National Primary Drinking Water Regulations; Radionuclides; Proposed Rule." *Code of Federal Regulations*.
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- WAC 173-201A. "Water Quality Standards for Surface Waters of the State of Washington." Washington Administrative Code, Olympia, Washington.
- WAC 246-290. "Group A Public Water Systems." Washington Administrative Code, Olympia, Washington.